Roofing Issues: Decks to Dockets
September 11-13, 2014 – Austin, TX

Emerging Technical Issues Posing Liability Risks for Roofing Contractors

presented by

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Topics

- Attic ventilation
- Steel deck issues
- Polyiso. insulation
- Asphalt
- Fastener placement
- Design issues

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Attic ventilation

- 1:150 rule
- 1:300 exception
  - IBC 2012:
    - 50 to 80% NFVA at or near the ridge, or
    - Vapor retarder on the warm-in-winter side
  - IRC 2012:
    - 40 to 50% NFVA at or near the ridge, or
    - In Climate Zones 6, 7 and 8, a vapor retarder on the warm-in-winter side

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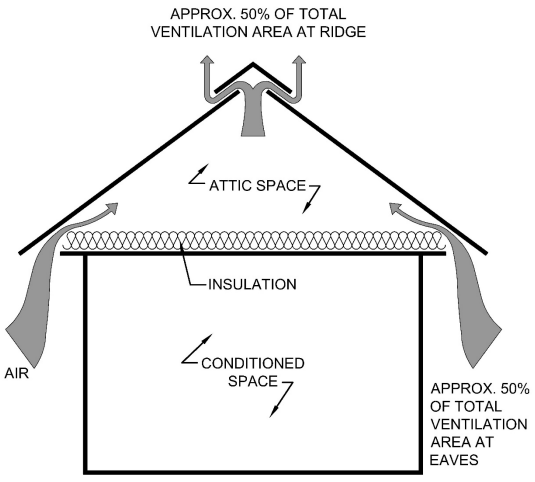
"Balanced" ventilation



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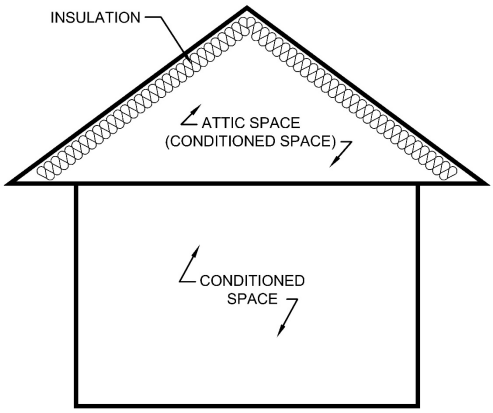
Unvented, conditioned attics



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Additional information

Attic ventilation

- *The NRCA Roofing Manual: Architectural Metal Roofing, Condensation and Air Leakage Control, and Reroofing–2014,* pages 216-220
- *Professional Roofi*ng, "Tech today," Sept. 2014
- *Professional Roofing*, "Tech today," Oct. 2014

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Steel roof decks

We now know the rationale for FM Approval's 2013 classification changes

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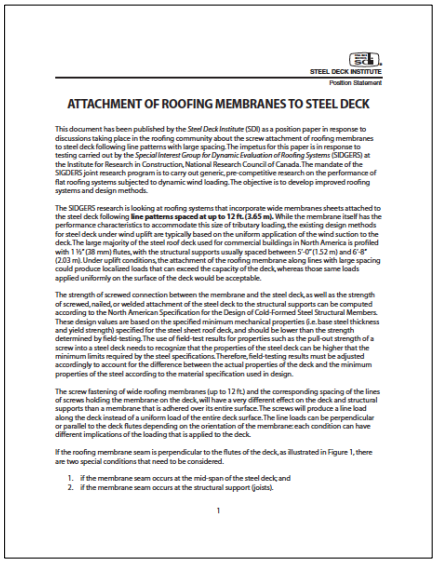
SDI bulletin



STEEL DECK INSTITUTE
Position Statement

ATTACHMENT OF ROOFING MEMBRANES TO STEEL DECK

This document has been published by the *Steel Deck Institute* (SDI) as a position paper in response to discussions taking place in the roofing community about the screw attachment of roofing membranes to steel deck following line patterns with large spacing. The impetus for this paper is in response to testing carried out by the *Special Interest Group for Dynamic Evaluation of Roofing Systems* (SIDGERS) at the Institute for Research in Construction, National Research Council of Canada. The mandate of the SIDGERS joint research program is to carry out generic, pre-competitive research on the performance of flat roofing systems subjected to dynamic wind loading. The objective is to develop improved roofing systems and design methods.

The SIDGERS research is looking at roofing systems that incorporate wide membranes sheets attached to the steel deck following **line patterns spaced at up to 12 ft. (3.65 m).** While the membrane itself has the performance characteristics to accommodate this size of tributary loading, the existing design methods for steel deck under wind uplift are typically based on the uniform application of the wind suction to the deck. The large majority of the steel roof deck used for commercial buildings in North America is profiled with 1 ½" (38 mm) flutes, with the structural supports usually spaced between 5'-0" (1.52 m) and 6'-8" (2.03 m). Under uplift conditions, the attachment of the roofing membrane along lines with large spacing could produce localized loads that can exceed the capacity of the deck, whereas those same loads applied uniformly on the surface of the deck would be acceptable.

The strength of screwed connection between the membrane and the steel deck, as well as the strength of screwed, nailed, or welded attachment of the steel deck to the structural supports can be computed according to the North American Specification for the Design of Cold-Formed Steel Structural Members. These design values are based on the specified minimum mechanical properties (i.e. base steel thickness and yield strength) specified for the steel sheet roof deck, and should be lower than the strength determined by field-testing. The use of field-test results for properties such as the pull-out strength of a screw into a steel deck needs to recognize that the properties of the steel deck can be higher that the minimum limits required by the steel specifications. Therefore, field-testing results must be adjusted accordingly to account for the difference between the actual properties of the deck and the minimum properties of the steel according to the material specification used in design.

The screw fastening of wide roofing membranes (up to 12 ft.) and the corresponding spacing of the lines of screws holding the membrane on the deck, will have a very different effect on the deck and structural supports than a membrane that is adhered over its entire surface. The screws will produce a line load along the deck instead of a uniform load of the entire deck surface. The line loads can be perpendicular or parallel to the deck flutes depending on the orientation of the membrane: each condition can have different implications of the loading that is applied to the deck.

If the roofing membrane seam is perpendicular to the flutes of the deck, as illustrated in Figure 1, there are two special conditions that need to be considered.

1. if the membrane seam occurs at the mid-span of the steel deck; and
2. if the membrane seam occurs at the structural support (joists).

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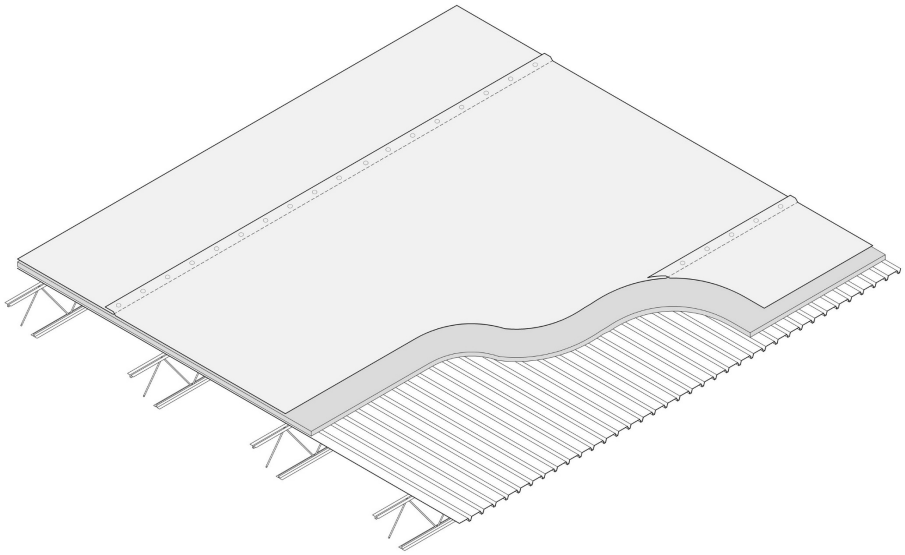
- Decks designed for joist spacing between 5' and 6' 8" o.c.
- Steel decks designed for uniform loading
- Seam-fastened single-ply membranes are a concern

Membrane seams across deck flutes



SDI: 3.8 X moment (deck); 2 X load (joists)

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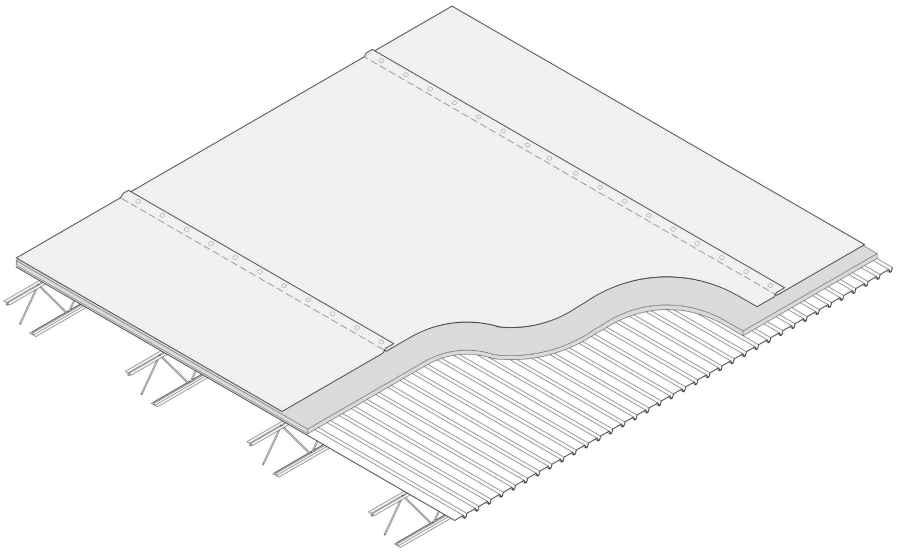
Membrane seams in deck flute direction



SDI: 12 X bending moment and shear (deck)

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SDI bulletin -- Conclusion

"…SDI does not recommend the use of roofing membranes attached to the steel deck using line patterns with large spacing unless a structural engineer has reviewed the adequacy of the steel deck and the structural supports to resist to wind uplift loads transmitted along the lines of attachment. Those lines of attachment shall only be perpendicular to the flutes of the deck."

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NRCA interim recommendations

- Beware of the situation
- NRCA is investigating further…

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Polyisocyanurate insulation

- LTTR implementation
- Dimensional stability issues

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PIMA Quality Mark^{CM} program

Thickness	LTTR (2004 – 2013)	New LTTR (Jan. 2014)
1 inch	6.0	5.6
1.5 inches	9.0	8.6
2 inches	12.1	11.4
3 inches	18.5	17.4
4 inches	25.0	23.6

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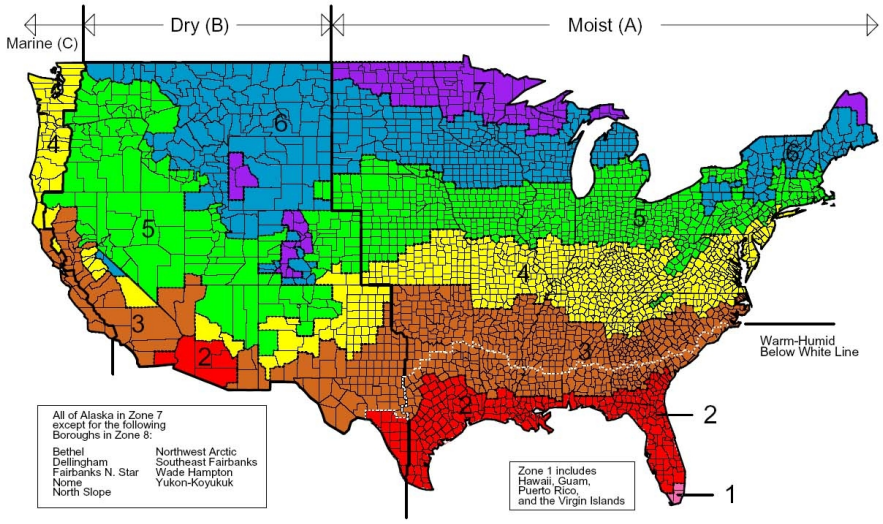
Climate zones

IECC 2012, Section C301 and Sec. R301—Climate Zones



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Thickness/layers for R-value

Required R-value	Layers/Thicknesses
R-20[1,2]	2 layers of 1.8 inch
R-25[3]	2 layers of 2.2 inch
R-30[4]	2 layers of 2.6 inch
R-35[5]	2 layers of 3.1 inch

[1] IECC 2009, Climate Zones 2-6
[2] IECC 2012, Climate Zones 1-3
[3] IECC 2012, Climate Zones 4-5
[4] IECC 2012, Climate Zone 6
[5] IECC 2012, Climate Zone 7-8

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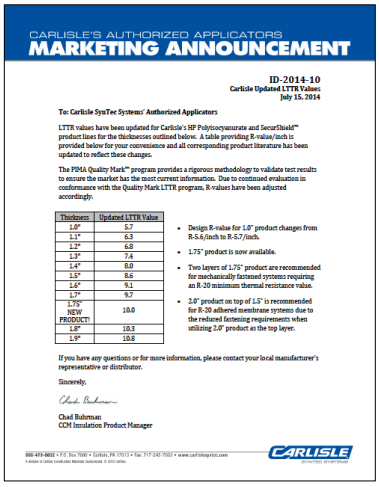
July 2014 LTTR changes



CARLISLE'S AUTHORIZED APPLICATORS
MARKETING ANNOUNCEMENT

ID-2014-10
Carlisle Updated LTTR Values
July 15, 2014

To: Carlisle SynTec Systems' Authorized Applicators

LTTR values have been updated for Carlisle's HP Polyisocyanurate and SecurShield™ product lines for the thicknesses outlined below. A table providing R-value/inch is provided below for your convenience and all corresponding product literature has been updated to reflect these changes.

The FM4A Quality Mark™ program provides a rigorous methodology to validate test results to ensure the market has the most current information. Due to continued evaluation in conformance with the Quality Mark LTTR program, R-values have been adjusted accordingly.

Thickness	Updated LTTR Value
1.0"	5.7
1.1"	6.3
1.2"	6.8
1.3"	7.4
1.4"	8.0
1.5"	8.6
1.6"	9.1
1.7"	9.7
1.75" NEW PRODUCT!	10.0
1.8"	10.3
1.9"	10.8

- Design R-value for 1.0" product changes from R-5.6/inch to R-5.7/inch.
- 1.75" product is now available.
- Two layers of 1.75" product are recommended for mechanically fastened systems requiring an R-20 minimum thermal resistance value.
- 2.0" product on top of 1.5" is recommended for R-20 adhered membrane systems due to the reduced fastening requirements when utilizing 2.0" product as the top layer.

If you have any questions or for more information, please contact your local manufacturer's representative or distributor.

Sincerely,

Chad Buhrman
CCM Insulation Product Manager

CARLISLE

Updated LTTR values:

- 1.0 inch: 5.6 to 5.7
- 1.75 product available
- Mechanically-attached:
  - (2) 1.75 inch for R-20
- Adhered:
  - 2.0 inch top layer
  - 1.5 inch bottom layer

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Does it really matter?

Consider allowable manufacturing tolerances

- ASTM C1289:
  - Board length and width: ±¼ inch
  - Thickness tolerance: "…shall not exceed ⅛ in. (3.2 mm), and the thickness of any two boards shall not differ by more than ⅛ in (3.2 mm)…
- Equivalent LTTR of thickness tolerance: ±0.7
- Equivalent LTTR of 0.1-inch-thickness: 0.56

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Dimensional stability issues

- Board growth
- Board shrinkage
- Board cupping
- Board bowing

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Polyiso. facer sheets

ASTM C1289, Type II:

- Class 1 (cellulose/glass fiber facers):
  - Grade 1 – 16 psi
  - Grade 2 – 20 psi
  - Grade 3 – 25 psi
- Class 2 (coated glass facers):
  - Grade 1 – 16 psi
  - Grade 2 – 20 psi
  - Grade 3 – 25 psi
- Class 3 (uncoated glass facers)
- Class 4 (high density):
  - Grade 1 – 80 psi
  - Grade 2 – 110 psi
  - Grade 3 – 140 psi

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Additional information

Polyisocyanurate insulation

- *The NRCA Roofing Manual: Membrane Roof Systems–2011,* pages 62-64
- NRCA Industry Issue Update: Polyiso's R-value, Jan. 2014
- *Professional Roofing*, "A question of accuracy," May 2014
- *Professional Roofing*, "Tech today," March 2013

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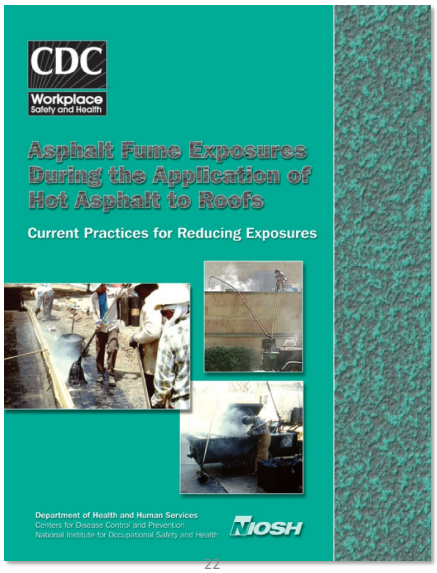
Asphalt

June 2003



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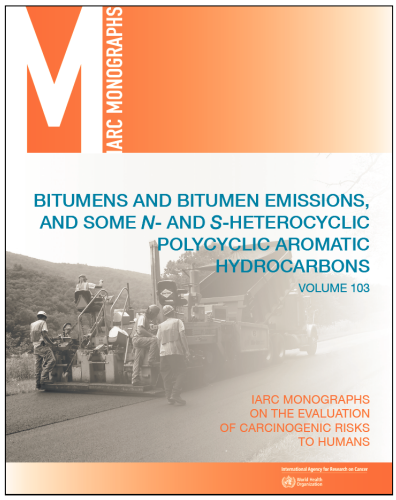
Asphalt

May 2013



IARC Monograph – 103:

- Group 2A –Probably carcinogenic to humans
- Pgs. 160 – 165 specific to "Roofing workers exposed to bitumens"

No new regulation (yet)

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NRCA asphalt testing -- 1989

- 26 asphalt samples
- EVTs:
  - Type III (125 cps) 400 – 430 F
  - Type III (75 cps) 420 – 470 F
  - Type IV (125 cps) 420 – 455 F
  - Type IV (75 cps) 445 – 485 F
- FPs:
  - Not reported

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NRCA asphalt testing -- 2000

- 19 asphalt lots sampled
- EVTs:
  - Type III (mop) 390 – 440 F
  - Type III (spreader) 415 – 475 F
- FPs: 585 – 640 F
- ASTM D312 compliance:
  - 10 of 19 did not comply

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NRCA asphalt testing – 2014 (to date)

- 14 asphalt lots (7 suppliers) sampled
- EVTs:
  - Type III (mop) 424 – 462 F
  - Type III (spreader) 452 – 486 F
  - Type IV (mop) 455 – 482 F
  - Type IV (spreader) 480 – 506 F
- FPs: 615 – 660 F
- 10 of 14 do not comply with ASTM D312's physical property requirements

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Proposed revision to ASTM D312

Currently being balloted

- Maximum heating temp.: 550 F (575 F min. FP)
- Maximum EVTs:
  - Type III (mop) 430 F
  - Type III (spreader) 455 F
  - Type IV (mop) 470 F
  - Type IV (spreader) 485 F
- Lot-specific package labeling of EVT

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NRCA's interim recommendations

- Consult manufacturers' installation requirements and MSDS.
- Carefully select asphalt
- Beware of actual FPs; max. heating temp. should be FP – 25 F
- Beware of actual EVTs
- Make field crews aware

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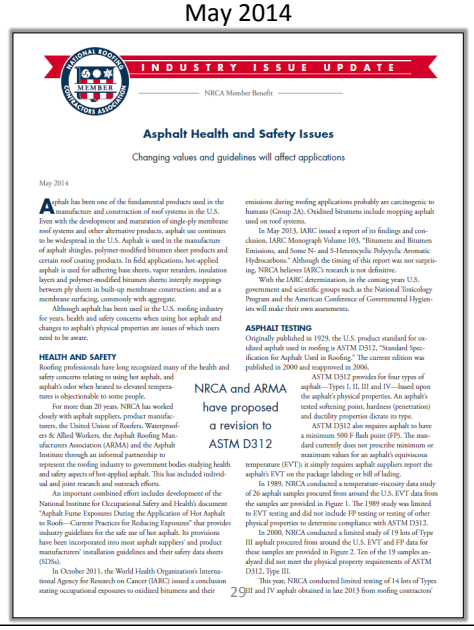
Industry Issue Update

May 2014



INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Asphalt Health and Safety Issues

Changing values and guidelines will affect applications

May 2014

Asphalt has been one of the fundamental products used in the manufacture and construction of roof systems in the U.S. Even with the development and maturation of single-ply membrane roof systems and other alternative products, asphalt use continues to be widespread in the U.S. Asphalt is used in the manufacture of asphalt shingles, polymer-modified bitumen sheet products and certain roof coating products. In field applications, hot-applied asphalt is used for adhering base sheets, vapor retarders, insulation layers and polymer-modified bitumen sheets; interply moppings between ply sheets in built-up membrane construction; and as a membrane surfacing, commonly with aggregate.

Although asphalt has been used in the U.S. roofing industry for years, health and safety concerns when using hot asphalt and changes to asphalt's physical properties are issues of which users need to be aware.

HEALTH AND SAFETY

Roofing professionals have long recognized many of the health and safety concerns relating to using hot asphalt, and asphalt's odor when heated to elevated temperatures is objectionable to some people.

For more than 20 years, NRCA has worked closely with asphalt suppliers, product manufacturers, the United Union of Roofers, Waterproofers & Allied Workers, the Asphalt Roofing Manufacturers Association (ARMA) and the Asphalt Institute through an informal partnership to represent the roofing industry to government bodies studying health and safety aspects of hot-applied asphalt. This has included individual and joint research and outreach efforts.

An important combined effort includes development of the National Institute for Occupational Safety and Health's document "Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs—Current Practices for Reducing Exposures" that provides industry guidelines for the safe use of hot asphalt. Its provisions have been incorporated into most asphalt suppliers' and product manufacturers' installation guidelines and their safety data sheets (SDSs).

In October 2011, the World Health Organization's International Agency for Research on Cancer (IARC) issued a conclusion stating occupational exposures to oxidized bitumens and their emissions during roofing applications probably are carcinogenic to humans (Group 2A). Oxidized bitumens include mopping asphalt used on roof systems.

In May 2013, IARC issued a report of its findings and conclusion, IARC Monograph Volume 103, "Bitumens and Bitumen Emissions, and Some N- and S-Heterocyclic Polycyclic Aromatic Hydrocarbons." Although the timing of this report was not surprising, NRCA believes IARC's research is not definitive.

With the IARC determination, in the coming years U.S. government and scientific groups such as the National Toxicology Program and the American Conference of Governmental Hygienists will make their own assessments.

ASPHALT TESTING

Originally published in 1929, the U.S. product standard for oxidized asphalt used in roofing is ASTM D312, "Standard Specification for Asphalt Used in Roofing." The current edition was published in 2000 and reapproved in 2006.

ASTM D312 provides for four types of asphalt—Types I, II, III and IV—based upon the asphalt's physical properties. An asphalt's tested softening point, hardness (penetration) and ductility properties dictate its type.

ASTM D312 also requires asphalt to have a minimum 500 F flash point (FP). The standard currently does not prescribe minimum or maximum values for an asphalt's equiviscous temperature (EVT); it simply requires asphalt suppliers report the asphalt's EVT on the package labeling or bill of lading.

In 1989, NRCA conducted a temperature-viscosity data study of 26 asphalt samples procured from around the U.S. EVT data from the samples are provided in Figure 1. The 1989 study was limited to EVT testing and did not include FP testing or testing of other physical properties to determine compliance with ASTM D312.

In 2000, NRCA conducted a limited study of 19 lots of Type III asphalt procured from around the U.S. EVT and FP data for these samples are provided in Figure 2. Ten of the 19 samples analyzed did not meet the physical property requirements of ASTM D312, Type III.

This year, NRCA conducted limited testing of 14 lots of Types III and IV asphalt obtained in late 2013 from roofing contractors'

NRCA and ARMA have proposed a revision to ASTM D312

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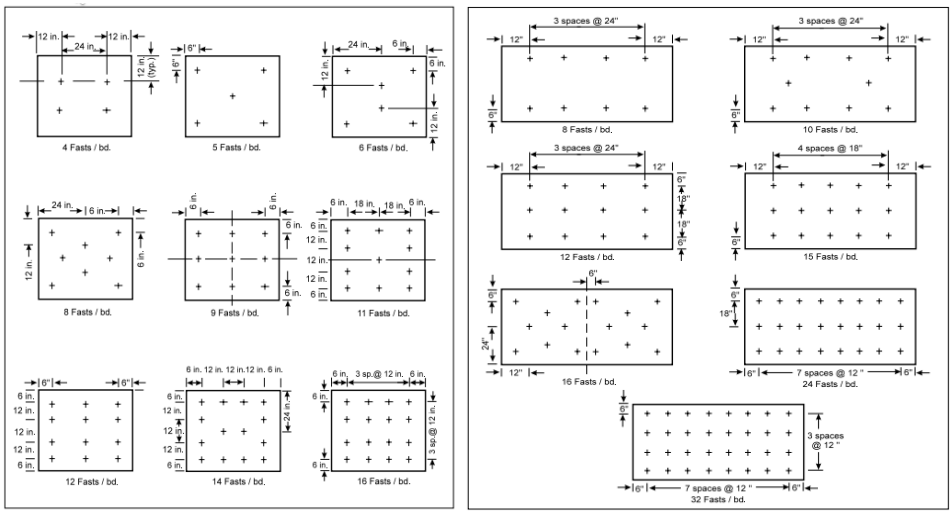
Fastener placement issues

FM Loss Prevention Data Sheet 1-29



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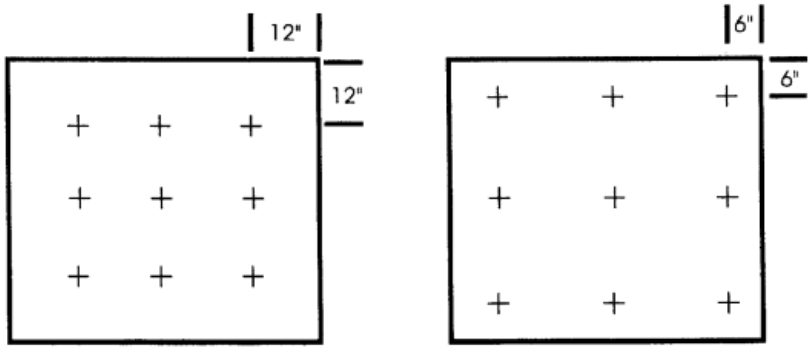
Fastener placement issues

FM Loss Prevention Data Sheet 1-29



105 psf

160 psf

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Wind design and FM testing/classifications include reasonable application tolerances and a safety factor

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Design issues

- High FM uplift classifications
- Class A fire resistance classifications
- Wind warrantees
- "…delegated empirical design process…"

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Contractors are being asked to take on more and more design responsibility…and liability

…and many are unknowingly accepting it.

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Be aware of your risks.

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Other topics…

Questions…?

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